Cisco CSIRT's Passive DNS Collection and Searching System

Henry Stern

Two Separate Problems: Questions and Answers

DNS Answers

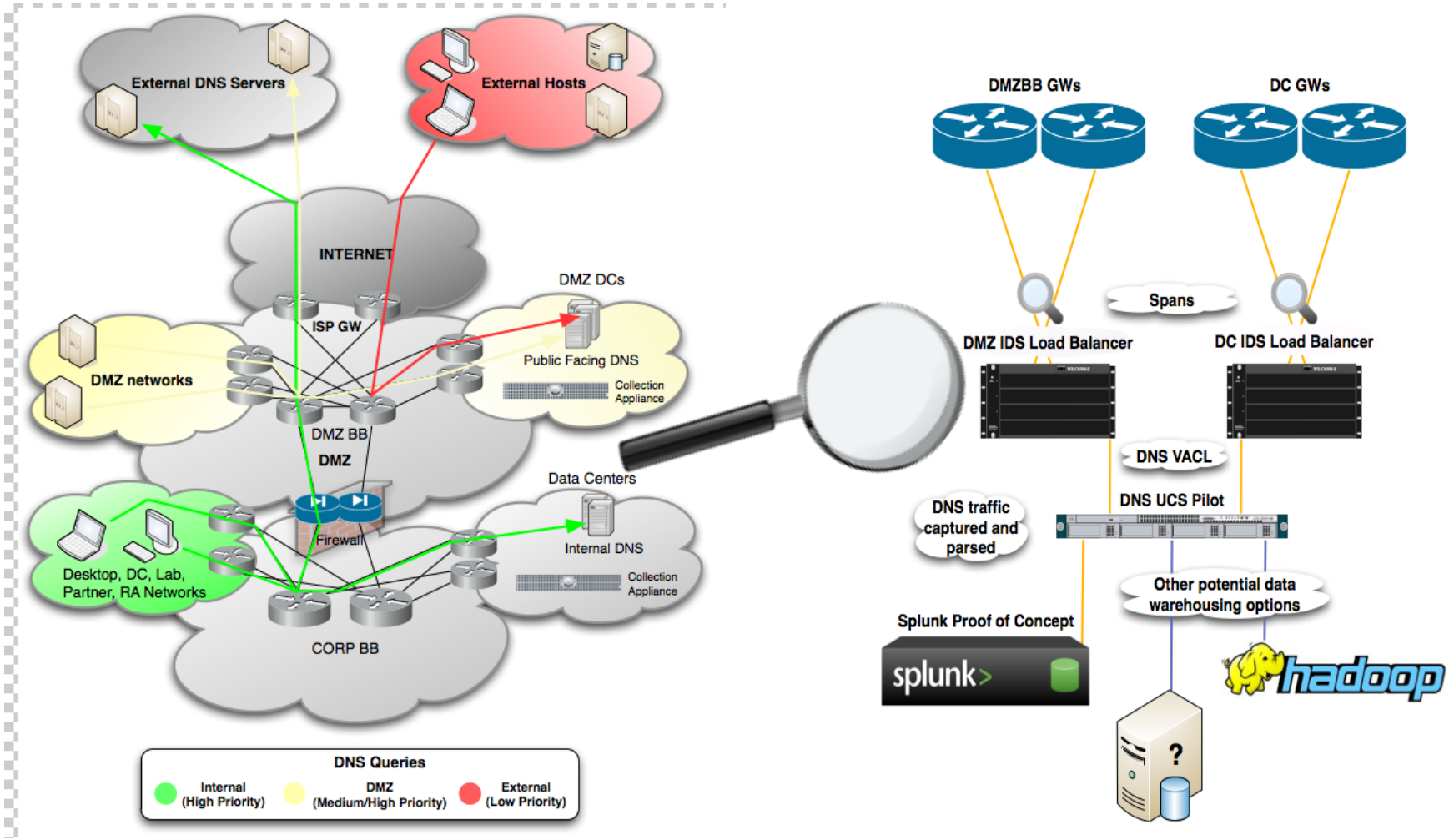
- Complex data:

  Time, source, destination, question, answer, additional records.
- What did a name resolve to and when?
- What else resolved to this IP?
- What else is served by this name server?
- Solution: Passive DNS Replication
- https://dnsdb.isc.org/
- http://www.bfk.de/bfk_dnslogger.html
- http://www.enyo.de/fw/software/dnslogger/

DNS Questions

- Simple data:
  - Source IP.
  - Destination IP.
  - Question – qname and qtype.
- Great for forensics.
- Who looked up this name?
- Who is a member of this botnet?
- What did this host look up?

DNS traffic capture design



How Much Data?

- 130k active Windows hosts at any given time.
- 90k active Linux hosts at any given time.
- 10 billion Netflows captured at zone boundaries.
- IDS sensors at all zone boundaries.
- 1 Tb of security event log data.

- 13 data centres, DMZs covered with PDNS.
- 4 billion DNS and NetBIOS packets captured per day.
- 300gb of traffic captured per day.

DNS Question Search Tool

- Data captured with ncaptool.
- Search engine written in Python+Pyrex.
- Uses libbind/Strangle, pyncap, IPy, pySubnetTree, list2re, pybloomfilter.
- Files are indexed with a Bloom filter.
  - Quickly determines whether a file contains entries that match a query.
  - Pre-computation by cron job.
- Distributed search client/server.
  - JSON-based protocol.
  - Use SSL certs for authentication.
  - Future: Switch to HTTPS+SRP.

Command Line Interface

```
usage: pdns-search [-h] [--src-ip [SRC_IP [SRC_IP ...]]]
                   [--dst-ip [DST_IP [DST_IP ...]]]
                   [--qname [QNAME [QNAME ...]]] [--qtype [QTYPE [QTYPE ...]]]
                   [--nbname [NBNAME [NBNAME ...]]]
                   [--nbtype [NBTYPE [NBTYPE ...]]]
                   [--nbsuffix [NBSUFFIX [NBSUFFIX ...]]]
                   [--max-results MAX_RESULTS] [--start START] [--end END]
                   [--no-extract] [--no-expand] [--no-progress]
                   [--print-server] [--print-protocol]
```

Demo – Mariposa Infections

```
$ pdns-search --qname bfisback.no-ip.org --max-results 4
```

Timestamp	Source	Destination	QName	QType
2012-08-21 12:26:28	ELIDED	64.102.255.44	bfisback.no-ip.org	A
2012-08-21 12:26:28	64.102.255.43	69.65.40.108	bfisback.no-ip.org	A
2012-08-21 13:03:19	ELIDED	64.102.255.44	bfisback.no-ip.org	A
2012-08-21 13:03:19	64.102.255.43	69.72.255.8	bfisback.no-ip.org	A

```
Search: 100% |##################| Time: 0:00:03 Files:  780/780
```

Using Our Tools

- Fill in gaps in Netflow coverage.
- Alert on queries for dangerous domain names.
- Look for patterns in queries to discover C2 servers.
- Monitor queries about high-value targets.
- Watch for new names hosted on dangerous networks.
- Discover new dangerous networks.

Future

- Tell us when DNS responses have changed.
- Automatically feed the data to other systems.
- Integrate our searches with external systems.
  - Logs (Splunk)
  - Flows (Lancope)
  - SenderBase Network Participation